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TWO NEW SPECIES OF BITING MIDGES AND A CHECK LIST OF THE GENUS *CULICOIDES* (DIPTERA: CERATOPOGONIDAE) FROM SRI LANKA

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Abstract.—Two new species of *Culicoides*, *C.* **schramae** and *C.* **krombeini** from Sri Lanka, are described and illustrated. Characters are presented to separate them from other species in the *similis* and *neavei* groups. A check list is presented of the 27 known *Culicoides* species of Sri Lanka.

The *Culicoides* fauna of Sri Lanka is poorly known and no check list has been published for this genus. Delfinado and Hardy (1973) listed 13 species occurring there, and an examination of the collections of Asian *Culicoides* at the U.S. National Museum of Natural History (USNM) adds records for two more species from Sri Lanka. Our studies of material collected by Davis and Rowe in 1970 and Messersmith and party in 1975 add 12 more species for a total of 27 species representing six subgenera. Two new species found in the latter collections are described here.

Check List of the *Culicoides* Species of Sri Lanka

Species	Delfinado and Hardy (1973)	In UNSM Collection before 1970	Sri Lanka Collections of 1970 and 1975
Subgenus *Avaritia* Fox			
actoni Smith	+	−	+
boophagus Macfie	+	−	−
brevipalpis Delfinado	+	−	−
brevitarsis Kieffer	−	−	+
jacobsoni Macfie	−	−	+

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CHECK LIST OF THE *CULICOIDES* SPECIES OF SRI LANKA (Continued)

Species	Delfinado and Hardy (1973)	In UNSM Collection before 1970	Sri Lanka Collections of 1970 and 1975
Subgenus *Culicoides* Latreille			
amamiensis Tokunaga	−	−	+
indianus Macfie	−	−	+
innoxius Sen and Das Gupta	+	+	+
peregrinus Kieffer	−	+	+
recurvus Delfinado	+	−	−
Subgenus *Haemophoructus* Macfie			
gemellus Macfie	−	−	+
gentilis Macfie	−	+	−
Subgenus *Meijerehelea* Wirth and Hubert			
histrio Johannsen	+	−	−
Subgenus *Oecacta* Poey			
schultzei (Enderlein)	+	−	+
Subgenus *Trithecoides* Wirth and Hubert			
anophelis Edwards	+	+	−
elbeli Wirth and Hubert	−	−	+
flaviscutatus Wirth and Hubert	+	+	+
palpifer Das Gupta and Ghosh	−	−	+
paraflavescens Wirth and Hubert	+	+	−
Subgenus Uncertain			
bilobatus Kieffer	+	−	−
ceylanicus Kieffer	+	−	−
distinctus Sen and Das Gupta	−	−	+
huffi Causey	+	−	+
krombeini, new species	−	−	+
new species 78, Wirth and Hubert, MS	−	−	+
parviscriptus Tokunaga	−	−	+
schramae, new species	−	−	+

Descriptions in this paper are based on ratios measured and determined with the following methods. The antennal ratio (AR) is determined by dividing the combined lengths of the last five flagellar segments by those of the first eight flagellar segments. The palpal ratio (PR) is obtained by dividing the length of the third palpal segment by its greatest breadth. In palpal proportions a line halfway between the oblique junction of the first two segments is the base line for measuring these segments. The proboscis/head ratio (P/H) is obtained by dividing the distance from the tip of the labrum-epipharynx to the torma, by the distance from the latter to the interocular seta base. Wing length is measured from the basal arculus to the wing tip,

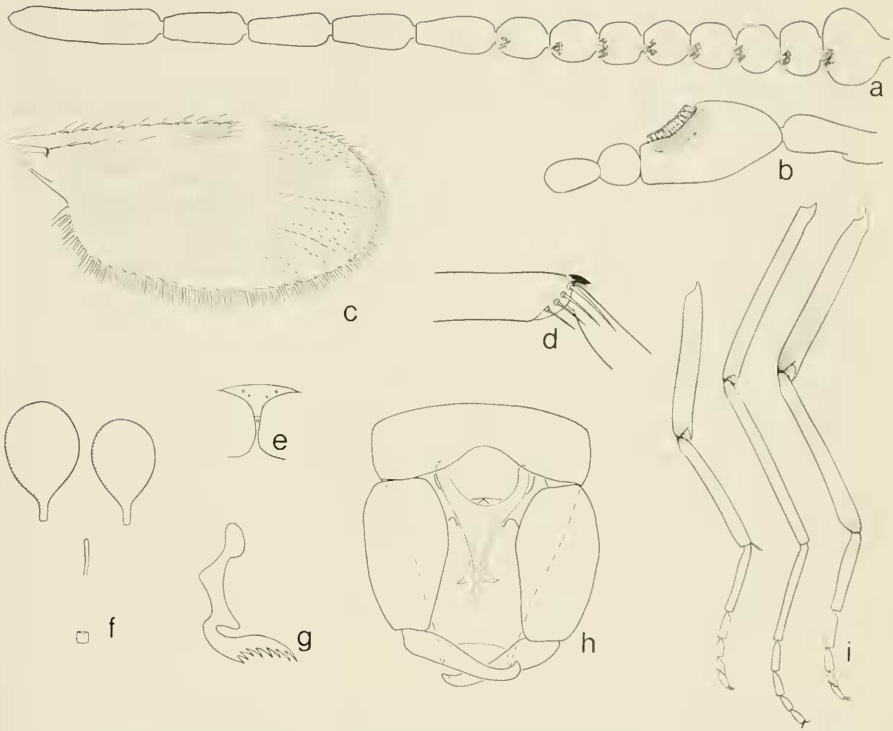

Fig. 1. *Culicoides schramae*. a–f, i, Female. g–h, Male. a, Antenna. b, Palpus. c, Wing. d, Tibial comb. e, Eye separation. f, Spermathecae. g, Parameres. h, Genitalia, parameres removed. i, Legs.

and the costal ratio (CR) is determined by measuring the distance from the basal arculus to the end of the costal vein and dividing this value by the wing length. The spermathecal measurements include the sclerotized portion of the neck.

Culicoides schramae Giles, Wirth, and Messersmith, New Species
Fig. 1

Female Holotype.—Wing length 0.85 mm.

Head: Eyes bare, almost contiguous, interocular space (Fig. 1e) narrowly wedge-shaped. Antennal flagellar segments (Fig. 1a) with lengths in proportion of 13-9-9-10-11-11-11-11-18-19-19-20-34, AR 1.29; sensilla coeloconica present on antennal segments 3–10. Palpal segments (Fig. 1b) with lengths in proportion of 10-30-50-17-20; 3rd segment moderately swollen, sensory pit broad and shallow; PR 1.79. Proboscis short, P/H 0.63; mandible with 9 well-developed teeth.

Thorax: Dark brown. Legs (Fig. 1i) pale brown, knee spots black; femora pale at bases with faint subapical bands on fore- and midlegs; tibiae with subbasal pale rings; hindtibia with distal ½ pale, extreme tip slightly darkened; hindtibial comb (Fig. 1d) with 4 spines, the one nearest the spur longest.

Wing: Fig. 1c, pale spot over r-m crossvein covering ¾ of 1st radial cell, extending from vein M1 to broadly meet costa; stigma dark, extending to tip of 2nd radial cell; cell R5 with 2 poststigmatic pale spots almost merging, anterior one lying nearly entirely distad of costa, posterior one smaller and lying behind distal end of the 1st and touching vein M1 posteriorly; large distal pale spot in cell R5 indented on proximal side, not touching vein M1, broadening anterodistally on wing margin; cell M1 with 2 pale spots, proximal one extending into cell M2 but broken by the dark line of vein M2, distal one ovate and reaching wing margin; cell M2 with pale streak from basal arculus to medial fork, small pale spot lying just behind medial fork, larger pale spot lying just in front of mediocubital fork, the distal pale spot quadrate and meeting wing margin; anal cell pale at base with large pale subapical spot, the latter with posterior extension that weakly, but broadly, meets wing margin. Cell M4 with large quadrate, subapical pale spot that meets wing margin. Macrotrichia sparse on distal ½ of wing; CR 0.55. Halter pale.

Abdomen: Pale brownish with 9th segment dark brownish. Spermathecae (Fig. 1f) 2, slightly unequal, measuring 0.062 by 0.039 mm and 0.055 by 0.032 mm, oval with long slender necks; rudimentary spermatheca and sclerotized ring present.

Male Allotype.—Genitalia (Fig. 1h) with 9th sternum short with shallow and moderately broad caudomedian excavation; 9th tergum moderately long with apicolateral processes short and slender. Basistyle moderately stout with roots long, heavy and well sclerotized; dististyle short, slender, and gently curved. Aedeagus with short basal arms, basal arch extending ⅓ of total length; tapering sharply to slender distal process with slender beadlike tip. Parameres (Fig. 1g) each stout with basal portion slightly bent anterolaterally; basal knob moderately expanded; stem stout, with ventral process well developed and directed ventrally; distal portion expanded, flat, bladelike, stout to tip, with lateral fringing spines.

Distribution.—Sri Lanka.

Types.—All on slides in phenol-balsam. Holotype ♀, Uggalkaltota, Sri Lanka, 5 Feb. 1970, coll. D. Davis and W. Rowe, light trap (type no. 72202, USNM). Allotype ♂ and paratype ♀, Kalli Villu, Wilpattu National Park, Sri Lanka, 12–13 June 1975, coll. D. H. Messersmith, G. L. Williams, and P. B. Karunaratne, at light; deposited in USNM. Paratype ♀, Medawachchiya, Anuradhapura District, Sri Lanka, 15 June 1975, same collectors as allotype, at light; will be deposited in the Colombo National Museum, Co-

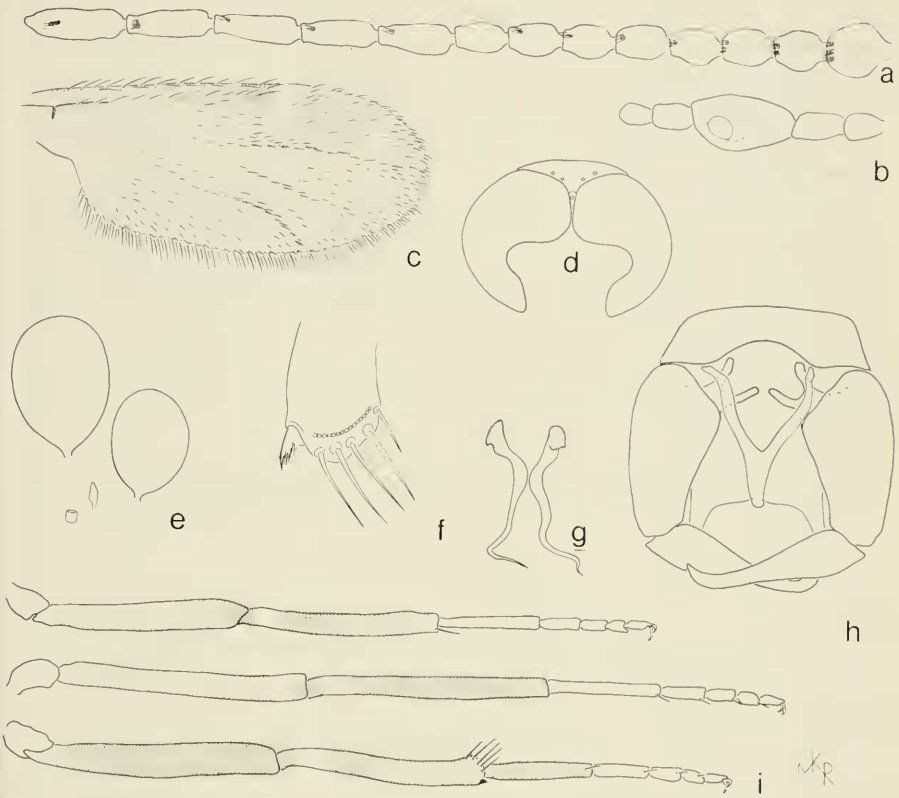

Fig. 2. *Culicoides krombeini*. a–f, i, Female. g–h, Male. a, Antenna. b, Palpus. c, Wing. d, Eye separation. e. Spermathecae. f, Tibial comb. g, Parameres. h, Genitalia, parameres removed. i, Legs.

lombo, Sri Lanka. Paratype ♀, Inginiyagala, Monaragala District, Sri Lanka, 1–5 June 1975, same collectors as allotype, deposited in USNM. Two paratype ♀, Kalutaluwewa, Colombo, Sri Lanka, 19 Feb. 1958, Medical Research Institute, light trap; one deposited in USNM, the other will be deposited in the National Museum at the University of Sri Lanka at Peradeniya.

Discussion.—The species is named for Ms. M'Lou Schram in recognition of her help during this study.

Culicoides schramae is similar to *C. huffi* Causey and *C. similis* Carter, Ingram, and Macfie of the *similis* group. *Culicoides huffi* differs in having sensilla coeloconica on antennal segments 3, 5, 7–10, AR 1.46, the distal pale spot in cell R5 rounder, and the proximal pale spot in cell M1 not lapping over into cell M2. *C. similis* has sensilla coeloconica like those of

C. huffi, and the posterior poststigmatic pale spot in cell R5 does not come in contact with vein M1.

Culicoides krombeini Giles, Wirth, and Messersmith, New Species
Fig. 2

Female Holotype.—Wing length 0.94 mm.

Head: Eyes bare, almost contiguous, interocular space (Fig. 2d) narrowly wedge-shaped. Antennal flagellar segments (Fig. 2a) with lengths in proportion of 20-15-16-15-14-15-15-15-22-22-25-24-30, AR 1.07; sensilla coeloconica present on antennal segments 3–9 and 11–15. Palpal segments (Fig. 2b) with lengths in proportion of 8-16-32-12-11; 3rd segment moderately swollen, sensory pit moderately broad and deep, opening by slightly smaller pore; PR 2.0. Proboscis moderately short, P/H 0.72. Mandible with 13 fine, well-developed teeth.

Thorax: Dark brown with small anterior portion and pleural regions lighter. Legs (Fig. 2i) with dark brown knee spots; forefemur pale brown, mid- and hindfemora darker brown with base and apex of midfemur lighter and base of hindfemur lighter; tibiae dark brown with subbasal pale bands; hindtibial comb (Fig. 2f) with 4 spines, the one nearest the spur but slightly longer.

Wing: Fig. 2c, second radial cell long and narrow. Pale spot over r-m crossvein covering base of 1st radial cell, extending from vein M1 to radius; stigma moderately dark, covering all of 2nd radial cell and about ¾ of 1st radial cell; poststigmatic pale spot narrowly quadrate and extending posterad about ½ width of cell R5; cells R5, M1, M2, M4 and anal cell distally each with distinct, moderately small, round, pale spot not attaining wing margin; cell M1 with moderately large basal pale spot in line with poststigmatic spot; cell M2 with moderately large, elongate pale spot lying behind medial fork and pale streak lying ½ way between the latter and distal pale spot; anal cell with small triangular pale spot basally; small pale spot just distad of arculus; macrotrichia long, coarse and abundant, extending nearly to base of wing; CR 0.59. Halter with dark brown knob, pale pedicel.

Abdomen: Light brown. Spermathecae (Fig. 2e) 2, unequal, measuring 0.067 by 0.023 mm and 0.051 by 0.037 mm, oval with very short necks; rudimentary spermatheca and sclerotized ring present.

Male Allotype.—Genitalia (Fig. 2h) with 9th sternum short with moderately deep and broad caudomedian excavation; 9th tergum relatively long, apicolateral processes long and slender. Basistyle moderately stout with roots long and slender; dististyle slender and slightly hooked. Aedeagus with slender basal arms, basal arch extending 3/5 of total length; distal process slender with rounded tip. Parameres (Fig. 2g) each with expanded, sclerotized basal knob; sinuous midportion slightly swollen proximally and gradually tapering distally to end in simple filamentous tip abruptly bent ventrally.

Distribution.—Sri Lanka.

Types.—All on slides in phenol-balsam. Holotype ♀, Kalli Villu, Wilpattu National Park, Puttalam District, Sri Lanka, 13 June 1975, coll. D. H. Messersmith, G. L. Williams, P. B. Karunaratne, at light (type no. 72205, USNM). Allotype ♂ and paratype ♀, same data as holotype. Holotype and allotype deposited in USNM. Paratype female will be deposited in the Colombo National Museum at Colombo, Sri Lanka.

Discussion.—This species is named in honor of Dr. Karl V. Krombein of the Smithsonian Institution in recognition of his leadership in organizing and directing the Smithsonian Ceylonese Insect Project.

Culicoides krombeini is similar to *C. shermani* Causey in the *neavei* group. The latter species, however, has wing macrotrichia that are longer and coarser and covering more of the wing; a dark area on the anterior margin of cell R5 distal to the poststigmatic spot, a smaller basal pale spot in cell M1, the distal pale spot in the anal cell elongate rather than round; and, most distinctive of all, a much deeper palpal pit with a small, longitudinal, oval pore.

Literature Cited

Delfinado, M. D. and D. E. Hardy. 1973. A Catalog of the Diptera of the Oriental Region. Vol. I. Suborder Nematocera. The University Press of Hawaii, Honolulu. 618 pp.